THE BIOLOGY AND DESCRIPTION OF A NEW GIANT SKIPPER FROM ARIZONA

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Perhaps the most fascinating of desert butterflies are the rare Giant Skippers of the genus *Megathymus*. Despite their relatively large size, their swift erratic flight over the desert shrubbery makes them most difficult to capture. Nor do you follow after them in headlong pursuit for this would be dangerous folly. The Giant Skipper of the Chihuahuan Desert, *Megathymus mariæ*, inhabits the limestone hillside studded with Lechuguilla or Spanish Dagger (*Agave lecheguilla*) and puncturing your leg with its poisonous spines is a warning long remembered.

Unless very keen eyed, you seldom see a Giant Skipper resting on a rock or Lechuguilla point until the sound of whirring wings tells you "There it goes." Its flight is erratic and it may skim back and forth over the etched limestone ledges and patches of Spanish Dagger and finally come to rest somewhere if you have been able to follow it all this time. Sometimes, like a drone bumblebee, it flits back and forth, hither and yon, to finally rest on the very spot left some time before. At best they are unpredictable and so is your collecting. You will undoubtedly do some earnest stalking for each one captured and, although they may be newly emerged, such is the power of their wings that they will damage them before you can get them out of the net and into the cyanide jar—no matter what speed you practice.

Night collecting with a lantern or flashlight may reward you with a fine specimen if you are lucky. Dr. John Comstock, however, has demonstrated that the only sure way of obtaining perfect specimens is by collecting the larvæ just before pupation, or collecting the pupæ just before emergence. This sounds simple enough, but it takes a lot of desert lore to know where to hunt for your specimens, let alone find them.

Biology

In late June of 1946, the writer, then on active duty in Korea, received word that he had been granted a Guggenheim Postwar Fellowship to explore and study the Life of the North American Deserts. During the fellowship year, commencing October 1, 1946, two expeditions were made as well as many shorter trips. On one of these lesser jaunts, while living in Benson, Arizona, an interesting discovery was made. It was August 21, 1947, and about one month after the first summer rains had resurrected the desert

flora and activated the insect life. Imagine, then, finding the freshly constructed cone of a Giant Skipper where a week or two earlier none had been in evidence. Naturally I thought I had discovered *Megathymus neumogeni*. The turret was several inches high and coming out of the center of a small, low plant of Beargrass or Soapweed (*Yucca elata*). The plant was practically prostrate and dying from the attack of a larva that was literally eating the heart of it, (see Plate 15). The cylindrical cone constructed by the larva was made of silk, generously mixed with chewed-up yucca root. The accumuluation of much frass or coarse fibrous droppings indicated that the larva was growing rapidly in the rainy period of the year.

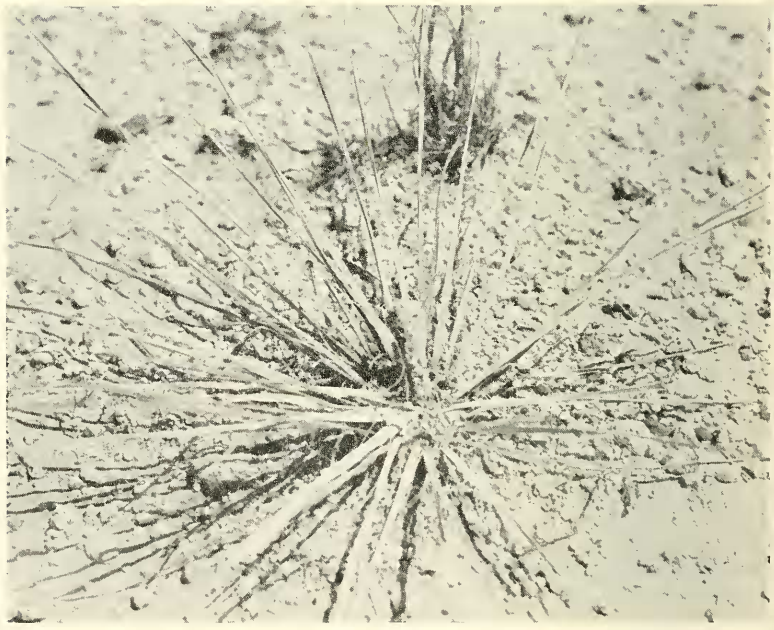

PLATE 15

Larval tower in a young plant of *Yucca elata* dying from attacks of the larva of *M. y. arizonæ* n. subsp.

I marked the spot and next day sallied forth with a spade and a hatchet and with some effort dug deep enough in the hard clay to make certain that I would not injure the larva or cut its tube. Later that day I explored its burrow as I snipped open certain sections of it. The inner surface of the tube was formed of a thick woven layer of dark golden brown silk which was very tough and fibrous. The larva was 53 mms. long at this time and I thought almost mature. There was no sign of the white powder that later lined the tube. In May, 1947, an empty tube of a *Megathymus* sp. found in *Yucca Schotti* at a considerable elevation in the Santa Catalinas, informed me that the tubes become heavily coated with white powder. I taped up the cut sections and that night the larva sewed up the cut margins with new silk. I planted the yucca root section in damp soil to prevent desiccation of the living plant tissues.

One month later, on September 21, I decided that the larva should by now be mature, and again opened up the tube. On this occasion I gave more study to the interesting creature and took some photos. The larva proved to be a good subject for photography as long as the photo was taken of its back, but it was almost impossible to get a side view shot as the larva always rotated so that it would have a firm footing. The larva now measured 62 mms. long and 9 mms. in breadth. Its coloration was a dull chromish yellow, dorsally, and dull bluish white ventrally. The skin was very soft and velvety to the touch. The sclerotized shield, just caudad of the head, was blackish with a central whitish cross stripe. The heart was evident along the dorsal line and the heart beat was timed at 94 beats per minute. A flaky powder, crystalline white, was at this time being formed on the underside of the tenth and eleventh abdominal segments which bear no prolegs. The prolegs were on segments six to nine and the anal pair was on the twelfth or caudal segment. Later on, by November, this organ was producing considerable quantities of this crystalline powder, which had the smooth, waxy feeling of powdered talc. This powder in late fall liberally coated the inner surfaces of the larval tube and the larva itself and appears to have the purpose of protecting the burrow from dampness and inhibiting the growth of fungi or bacteria. Dr. Comstock commented more fully on its function in 1934.

The spinnerets lay immediately caudad of the mandibles on the ventral surface of the head with their apices directed ventrad. The larva was feeding at the bottom of its burrow on the cambium layer of the root. Much of this yucca root was dead for these roots live in the soil for many years and the living portions are often only on one side from which a lateral sprout may arise. It is usually in this living lateral sprout or in a small plant that the

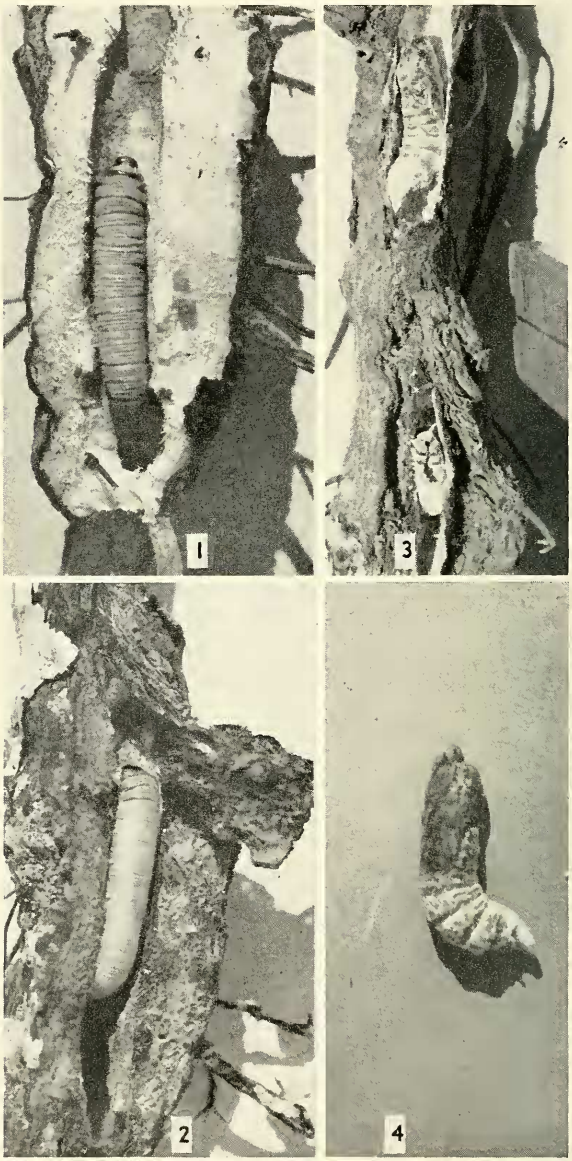

PLATE 16

Fig. 1. Larva of *M. y. arizonæ* n. subsp. resting near the bottom of its burrow and showing living plant tissue on which it feeds.
Fig. 2. Side view of larva of *M. y. arizonæ* n. subsp. going into tube.
Fig. 3. Pupa of *M. y. arizonæ* n. subsp. and tube of same liberally dusted with white powder, and below the pupa the exuvium of the larva.
Fig. 4. Pupa removed from its tunnel.

larva feeds and makes its burrow. The length of the tube below the soil varies from 15 to 24 inches. Continued search over a considerable tract of desert southwest of Benson revealed a total of five larvæ in their tubes. Just before moving to Tucson in early December, these were exhumed and taken along.

The characteristics of the larva are revealed by the photographs, and closest relationship is indicated to the giant skipper known through recent years as *Megathymus yuccæ navajo.* The particular race of *M. yuccæ* that occurs on the Mojave and Colorado Deserts in California is being given further study by specialists. In drawing comparisons in this paper, I refer to this race of *M. yuccæ navajo.* That skipper breeds in young shoots of the Joshue Tree, *Yucca brevifolia,* as Dr. Comstock has shown. The larva of *M. stephensi,* as revealed by Comstock, is quite distinct in size and form, differing considerably from *M. yuccæ.*

Pupation of our Benson, Arizona, specimens apparently occurred in early winter and before the writer realized it was probably hastened by the fact that the plant specimens were in the back protected porch of the house where they were not subjected to the extremes of cold on winter nights. Furthermore, Tucson is 2,400 feet in elevation and Benson 4,500 and naturally winters are more severe in Benson.

One day in late March a whir of wings which I thought was that of some ordinary cutworm moth, led me to examine my specimens. I had no idea that any desert butterfly would be emerging at this time of the year. To my chagrin I discovered an empty pupa case and realized too late that the whir of wings I had heard was not just a moth, but a very rare butterfly escaping out the back door. The four other samples had living pupæ. These maintained their position in their tubes by keeping the abdominal segments constantly flexed backwards so that the caudal spike-like process prevented them from slipping to the bottom of their burrows. I was quite surprised to observe the agility which the pupæ possessed in moving up or down their tubes. Under natural conditions it would appear that this agility would serve them admirably in moving up and down their tubes, regulated by the temperature of the soil surface. On warm, wintry days the pupa undoubtedly moves up into the turret or "sunning tower" where growth is stimulated and makes it possible for the butterfly to emerge at a time when the nights are still quite frosty in this transitional area of the Sonoran and Chihuahuan Deserts. As the cold of late afternoon develops, the lowering temperature, it is believed, drives the pupa downwards into the subsoil regions of its tube where temperature fluctuations are slight. Thus the pupa would escape destruction from all but very severe cold.

Unusual cold winters, however, must exact a toll of the pupæ

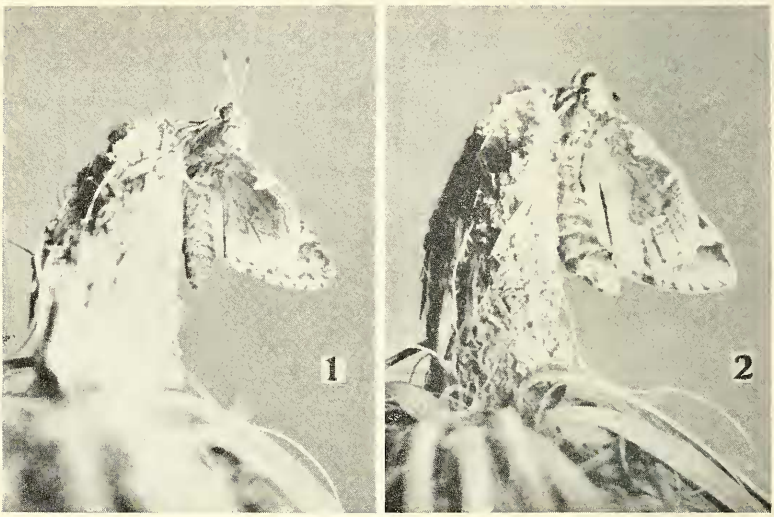

PLATE 17

Fig. 1. Newly emerged male, the Paratype, resting near the apex of its larval tower.

Fig. 2. Newly emerged female, the Allotype, resting near the tip of its tower.

as they do in any other creature. The winter of 1947-48 was such a one. On a pupa-hunting trip from Tucson to Benson and St. David on April 8, 1948, I found that the unusual cold had killed hardy tamarisks or salt cedars at St. David. Here, too, a rotting pupa found that day bore testimony to the fact that extreme cold in desert regions decimates an insect population. At Benson, where temperatures had not been so severe, an empty pupal case indicated that emergence had already taken place before April 8. The pupa is closely similar to that of *M. yuccæ navajo*. While photographing a pupa in its tube (see Plate 16), a sort of dust devil or gust of wind from nowhere, knocked it from its tube and injured it just a few days before eclosion would have taken place. Perhaps touching another prevented emergence so that only two specimens were obtained, a male and female. These were photo-

graphed clinging to the tips of their turrets (see Plate 17). Without disturbance the five pupæ would undoubtedly have developed into five adults. In early October, 1948, another trip was made to the Benson - St. David area, just before moving to Indio, California, but none of the samples obtained produced adults in the spring of 1949.

Megathymus yuccæ arizonæ Tinkham n. subsp.

This geographic race is most closely related to the Californian race we have been calling *M. yuccæ navajo*, from which it is easily distinguished in the male by the lack of a large discal spot in the apical end of the cell or reduction of the same; by the broad, buffy, marginal area on the upper side of the secondaries, as well as the grayer tone of the under surfaces and of the body. The female of the new subspecies differs from the female of *M. yuccæ navajo* by the broader, pale yellow, submarginal band of the primaries which at its anterior costal end is continguous with (in the type) and not disjuncted from the three anterior cells as in *M. y. navajo;* these three cells being silvered and semitransparent and not opaque as in *navajo*. The most conspicuous difference is the broad yellowish submarginal band of the secondaries which in *navajo* is reduced to several small buff spots at most or almost evanescent. The marginal areas, as well as the body and under surface of the wings, are paler and grayer in the Allotype of the new race. From *M. yuccæ coloradensis* Riley the new form is distinguished by slightly larger size and the broader colored bands of primaries and secondaries.

Holotype ♂, Mountain View, Pima County, Arizona (Lloyd M. Martin; reared from pupa in young shoot of *Yucca*, probably *Thornberi* McKelvey; collected March 14, 1951, and emerged March 24). Expanse: 55.0 mms. or 2.14 inches; body length 29.0 mms. or 1.08 inches. Holotype deposited in the Entomological collections of Los Angeles County Museum.

Description: Primaries: upper surface dark brown, not quite as blackish brown as in *navajo*, the basal area clothed with brownish buff hairs and the marginal area between the submarginal band and the fringe liberally dusted with gray scales. Submarginal band buff and closely similar to that in the male *navajo* and disjuncted from the silvery white post-discal cells, the third or most posterior of which from the costal margin being very minute and much smaller than the similar cell in *navajo*. The discal spot in the distal end of the cell and the small spot lying between it and the costal margin, which is prominent in *navajo*, is almost evanescent in the new species. The fringe is white with the usual

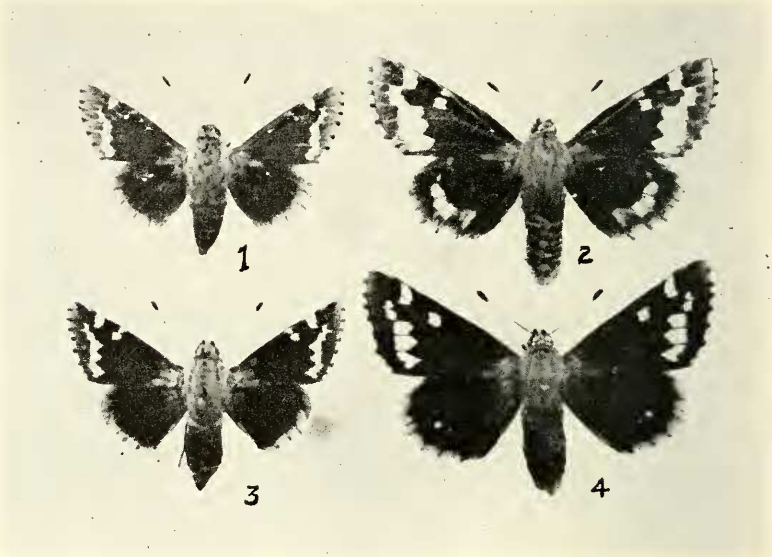

PLATE 18

Fig. 1. Paratype male of *M. y. arizonæ* and Fig. 2. Allotype female of *M. y. arizonæ n.* subsp. as compared to Fig. 3. Male of *M. yuccæ navajo* and Fig. 4. Female of *M. y. navajo.*

dark scales marking the ends of the veins. The markings on the underside are almost identical to those observed above.

Secondaries above, uniformly dark brown with a very broad, buff marginal and submarginal border. Secondaries below, dark brown, with entire marginal and submarginal areas hoary with grayish white scales. A conspicuous white triangular patch, not present in the male *navajo,* is located in the basal third of the open subcostal cell just anteriorad of the discal cell, and a small white crescent mark lies half way between it and the margin. The palpi and the mouth scales are white. The hairs clothing the thorax dorsally are bluish gray and ventrally dark brown, except for the area lying between the legs, which is pale grayish brown. The abdomen is grayish brown. Antennæ black above, silvery gray below, with the apical portions of the clubs darker.

Allotype ♀, Benson, Arizona, April 1, 1948, (Ernest R. Tinkham; reared from pupa collected in small shoot of *Yucca elata*). Expanse: 2.44 inches or 63 mms.; body length 1.13 inches or 29.0 mms. Type in the Tinkham Collection.

Description: Primaries: upper surface, dark brown with the posterior buff-colored cells of the submarginal band touching the three silvery white anterior cells which are semitransparent. In *navajo* these cells are not semitransparent and are separated from the rest of the buff-colored submarginal band. Marginal areas hoary. The distal end of the discal cell bears a quadrate, dark buff patch with a small irregular spot nearer the costal margin. Underside of the primaries paler than above, with the markings as above, except that the spot lying between the quadrate cell and the costal margin is larger below than above. Fringe is as in the male.

Secondaries: above, dark brown, with a broad, buffy marginal band and the three central cells of the submarginal band being buff, the fourth cell of this band, lying posterioradly of the other three, is dusted with dark brown scales. Below, the dark brown area is restricted to a large central patch which is almost completely encircled, except at the extreme base, by a very broad hoary margin. The white triangular spot, noted in the male, is also present in the same position with another small whitish spot half-way between it and the margin. Another small white dot is located at the anterior distal end of the discal cell. Collar, patagia and dorsal portions of the thorax of a dark bluish gray tone, merging to dark mouse brown on the posterior portions of the thorax. Abdomen above and below dark brownish black. Thorax below similar to that described in the Holotype.

Paratypes: Male, two: 1 male same data as the Holotype, emerged from pupa March 18, 1951, and deposited in the Los Angeles County Museum; one male, Benson, Arizona, collected by Ernest R. Tinkham in small shoot of *Yucca elata* and emerged March 29, 1948. Deposited in the Tinkham Collection. Measurements: Mt. View male. Expanse: 51.5 mms. or 2.03 inches; body length 25.5 mms. or 1 inch. Benson male. Expanse: 49.5 mms. or 1.9 inches; body length 23.5 mms. or 0.9 inch.

Male Paratypes closely similar to the Holotype; the Mountain View male identical, the Benson male differing slightly in the smaller discal spot, which is almost evanescent of the primaries.

Paratypes: Female, four: Mountain View, Lloyd M. Martin; collected in young shoots of *Yucca Thornberi* on March 14, 1951, and emerged on the following dates: March 18, 19, 22 and 26. Measurements: Expanse: 63.0-65-0 mms. or 2.5-2.56 inches; body length 32.0-35.0 mms. or 1.24-1.36 inches.

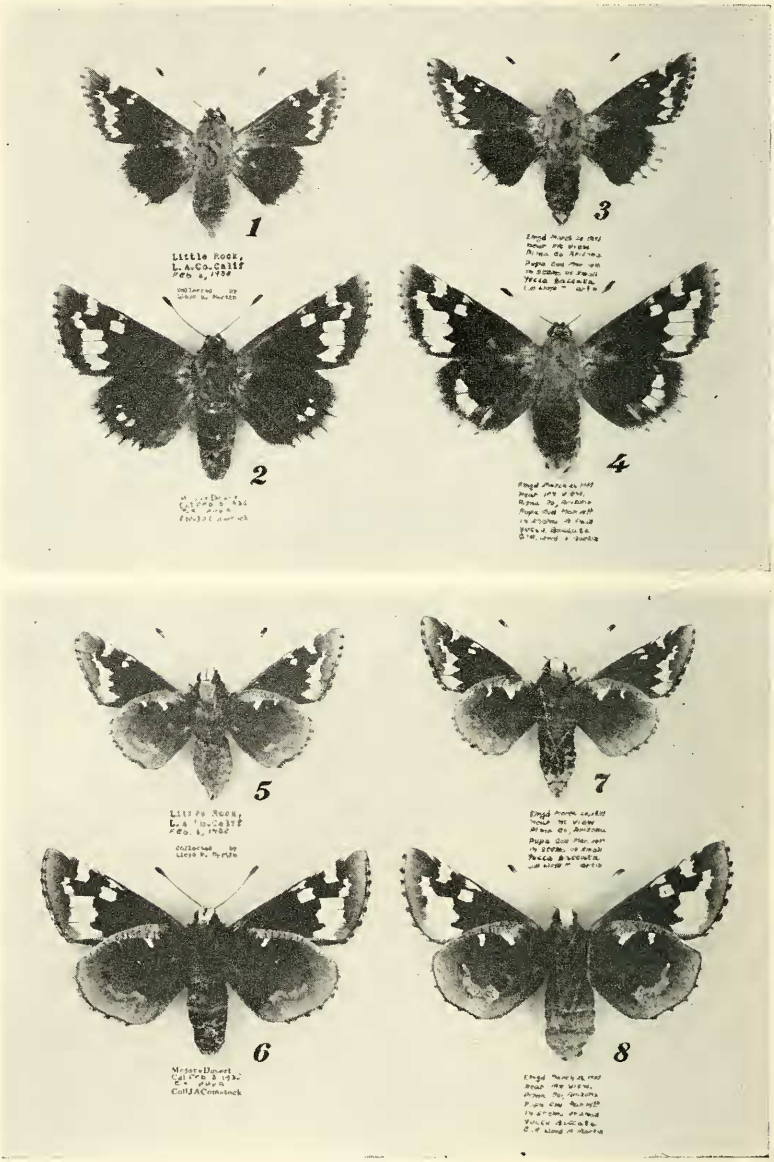

PLATE 19

Upper surfaces of: *Magathymus yuccæ navajo*, male and female (Figures 1 and 2) and of *M. yuccæ arizonæ*, Holotype (Figure 3) and *M. yuccæ arizonæ*, Paratype female (Figure 4) from Mountain View, Arizona.

Figures 5 to 8. Under surfaces of the same, as in upper four figures.

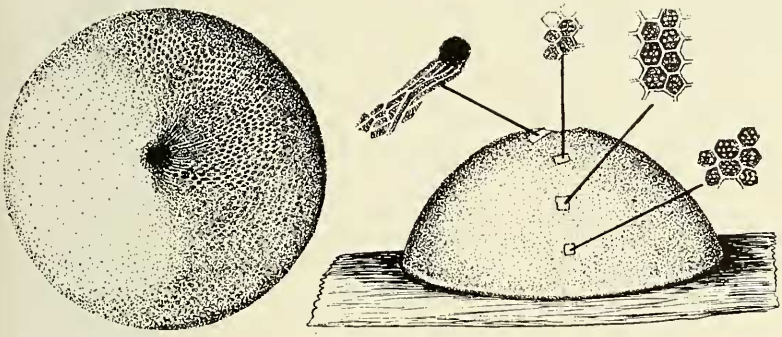

PLATE 20

Figure showing dorsal view of hemispheroid egg (x 20). Figure 2 on right, lateral view portraying chorionic cells at 90 x magnification. Line arrows indicate location of particular cells.

Female Paratypes closely similar to the Allotype, varying slightly in that the semitransparent anterior cells (3) of the submarginal band are not contiguous but very narrowly separated from the yellowish cells of the submarginal band which in these four Paratypes is slightly narrower than in the Allotype. Submarginal band of hind wing slightly reduced in two female Paratypes; otherwise, the female Paratypes appear identical to the Allotype. Disposition: three in the Los Angeles County Museum, one in the Tinkham Collection.

Egg: the single egg was discovered by Mr. Lloyd Martin, lepidopterist of the Los Angeles County Museum, on a late winter field trip to southeastern Arizona. On March 14, 1951, near Mt. View on the Tucson road to Benson, Mr. Martin observed, at 1:15 p.m. a female giant skipper ovipositing an egg near the heart of a young yucca shoot. At Mt. View there are extensive colonies of a dwarf yucca believed to be *Yucca Thornberi* McKelvey on the low, rounding knolls. The writer also examined one of these colonies on April 8, 1948, and again in early October of 1948, but failed to find any "sunning towers." The egg that Mr. Martin found was the exact coloration of the leaf of the Yucca plant — a foliage green of viridian-glaucous hue.

The egg was preserved. The incubation period at this time of the year is probably four to five weeks. Eggs of *Megathymus*

mariæ from the Hueco Tank Mts., Texas, laid on October 8, 1946, hatched in late October, giving an incubation period of about three weeks in what one would call warm weather. The newly hatched larvæ burrow into the heart of the young yucca sprouts. As they grow they burrow deeper into the cambium layers of the root until finally, when full grown, the ends of the burrows may be two feet below the ground level.

The large ovum is hemispheroid in shape; 3.5 mms. in basal diameter and 1.6 mms. in depth. Under low magnification (x 10) the chorionic surface appears much like that of beaten metal. At 30 power the chorion, in transmitted light, is profusely spotted with very minute whitish spots that stand out conspicuously against the darker ground color. Only by careful focusing in certain angles of reflected light can the chorionic sculpturation be observed. At best the hexagonal cells are seen to possess low, flat and rather broad cell walls. At 60 power and, better yet, at 90 the nature of the cell walls, in certain angles of reflected light can be more accurately discerned. Commencing at the basal periphery of the ovum we note these cells are poorly defined, irregularly pentagonal or hexagonal and with very low and rather heavy flattened cell walls. Moving about half-way up the side of the egg, we observe the cells to be more regularly hexagonal (see drawings), with slightly deeper and narrower cell walls. The floor of each cell has from 6-7 to 9, 10 or eleven of these whitish spots in transmitted light. In reflected light each spot is seen to be a shallow depression that gave the beaten metal appearance noted above. The exact nature of these spots or depressions is not known but thy are suspected to be some sort of air receptors. Nearer the micropylar area the cells take on an elongated appearance due chiefly to the obsolescence of the cross walls and the strengthening of the end walls which give the appearance of ridges running diagonally towards the micropylar area, where they converge to create much narrowed and much attenuated cells (see drawings). The micropylar area itself has a dark, glassy appearance like ice over deep water.

Larva: The mature stages of the larva have already been discussed. The young larva and intermediate stages are undescribed.

Pupa: The pupa has been adequately described in the introductory section and illustrated.

Comments: This new geographic race, *Megathymus yuccæ arizonæ* Tinkham, adds another member to the list of Giant Skippers breeding in the yuccas of the Southwestern Deserts. The yucca breeders appear as adults in late winter or in the very early spring when temperatures are still cool and the nights frosty.

The Giant Skipper known as *M. yuccæ navajo* breeds in the young shoots of the Joshua Tree (*Yucca brevifolia*) as Dr. John A. Comstock revealed many years ago. The new species *M. y. arizonæ* breeds in Beargrass (*Yucca elata*) and *Yucca Thornberi* and probably in other dwarf yuccas inhabiting southeastern Arizona.

The fall-appearing species of *Megathymus* seem to be restricted to the century plants or agaves in as far as is definitely known. Dr. Comstock has shown that *M. stephensi* breeds in the basal leaves of *Agave deserti*. *M. mariæ* breeds in *Agave lecheguilla* and the host plant of *M. neumogeni* is probably *Agave Parryi*. The host plant of the very rare super giant, *M. ursus* Poling, may well be the giants of the agaves, *A. Palmeri*.

Faunal Designation: The Benson and St. David areas are definitely within the confines of the Great Chihauhuan Desert for on the flat, clay mesas, we find codominant stands of the Creosote bush (*Larrea divaricata*) and the Southern Blackbrush (*Flourensia ceruna*). The additional presence of the Beargrass (*Yucca elata*) indicates that the floral conditions are approaching the upper limits or the zone where they will merge eventually with grasslands at around 5,000 feet elevation. Beargrass is an indicator of this ecotone. At Mountain View, some 19 miles southeast of Tucson, the colony of *Yucca Thornberi* can be considered as existing on the edge of the Great Sonoran Desert yet still in an ecotonic area. Thus the new giant skipper is a member of the Great Chihuahuan Desert Fauna and it can also be considered as dwelling on the border of the Great Sonoran Desert.

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